Do-more with Terminator I/O Modules

The Do-more T1H series CPUs are the new "brains" for the time-tested Terminator Field I/O hardware. The chip set inside includes the exact same processor as is used in the Do-more H2 series. The feature set for these CPUs is identical. Your ladder code is even portable between the two hardware platforms.

There are two T1H CPU options:

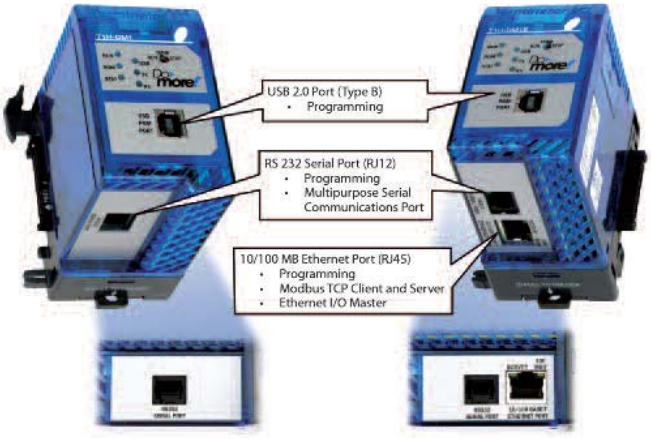
T1H-DM1 $585.00 (1) USB port, (1) full-duplex serial port

T1H-DM1E $745.00 (1) USB port, (1) full-duplex serial port, (1) Ethernet port

- Over 1M bytes total memory (includes program, data and documentation)
- Program/monitor/debug over any embedded communication port.
- Power supply modules are available for AC or DC power input. Add additional power supplies in-line with Terminator I/O modules as needed to power the modules AND to supply isolated 24 VDC power for field devices.
- 28 Terminator option analog and high-speed counter modules are available, from discrete and analog to high-speed counting

Note: Do-more CPUs are programmed with the new Do-more Designer software. DirectSOFT, and ladder programs developed with DirectSOFT, are not compatible with these CPUs.

T1H-DM1 **T1H-DM1E**


USB 2.0 Port (Type B)
• Programming
RS 232 Serial Port (RJ12)
• Programming
• Multipurpose Serial Communications Port
10/100 MB Ethernet Port (RJ45)
• Programming
• Modbus TCP Client and Server
• Ethernet I/O Master

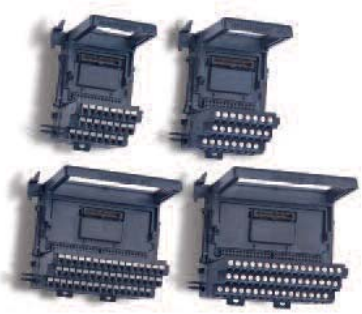
Compatible products include:

- C-more and C-more Micro HMI products
- Stride® Ethernet switches
- Connectivity to SureServo® and SureStep® motion products
- Variable frequency drives and AC motors
- Discrete and process sensors

Both T1H CPU modules ship with a coupon for free online training.

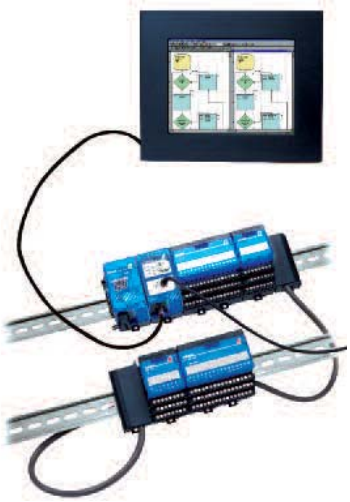
30 Days of Free Training!
Your purchase of this Do-more PLC product qualifies you for 30 days of free online training.
Visit www.do-morepictraining.com and enter the code above to take advantage of this offer!
INTERCONNECTING AUTOMATION

Pick Your Pieces and Drop 'em In



Two sizes of terminal bases accommodate all I/O modules

- Half-size bases for modules with up to 8 points for only $55.00 (T1K-08B, T1K-08B-1)
- Full size bases for modules with up to 16 points for only $69.00 (T1K-16B, T1K-16B-1)
- Triple-stack terminal blocks standard, easy to connect multi-wire devices
- Same bases for all I/O modules - AC, DC, and analog
- Screw and spring clamp terminals



Local expansion - up to two additional rows

- Full backplane expansion through cables
- Connect up to 16 modules across three total rows by plugging expansion cables from the side of one module to the side of the next. The system automatically recognizes the I/O.
- Optional cable that includes 24 VDC pins maximizes your power supply capability.

Power supplies - freedom of choice, freedom to expand

- DC power supplies for $111.00 (T1K-01DC), AC versions only $116.00 (T1K-01AC)
- AC supplies include 24 VDC auxiliary supply for convenient field device wiring
- Need more power for high current devices or modules? Just add another power supply before the next modules in the system!

8-channel I/O **16-channel I/O**

Four types of 8-channel I/O
Four types of 16-channel I/O
Two types of combination I/O
Thermocouple and RTD modules

Analog modules at a super low price per channel

- 8-channel input modules starting at $290.00
- 16-channel output modules starting at $591.00
- 0-20mA/4-20 mA and unipolar/bipolar voltage models available
- 14-channel thermocouple module only $519.00 (T1F-14THM)

Discrete I/O with the features you need

- 8-point input modules starting at only $69.00
- 16-point I/O starting at only $119.00
- All DC input modules are sink/source jumper configurable
- Diagnostic LEDs for blown fuse and 24 VDC power on applicable modules

8-point I/O

16-point I/O

Specialty module

- **Counter** module with pulse out, $311.00 (T1H-CTRIO)

DL205 I/O

- Connect DL205 Ethernet-based remote I/O drops to the optional Ethernet port on the -T1H-DM1E CPU
- Dozens of I/O option modules supported, including high-density discrete modules

Do-more with High-speed I/O!

High-speed operations

The T1H-CTRIO module is capable of a wide variety of high-speed input and output operations. Many of these operations take place on board the module, and are independent of the scan time of your PLC. With flexible 4-channel input and separate output channel design, these modules can satisfy high-speed counting, timing, and pulse catch operations, along with high-speed discrete output or several profile choices of pulse output operations. Not all combinations of input functions and output functions are possible within the resources of the module, but these examples are typical of the applications for these modules.

$311

High Speed Counter Moduel

Counting & timing up to 100 kHz:

T1H-CTRIO $311.00

Four 100 kHz inputs, and two 20-25 kHz pulse train outputs

Inputs Supported:

- Counter
- Quad Counter
- Pulse Catch
- Edge Timer
- Dual Edge Timer

Outputs Supported:

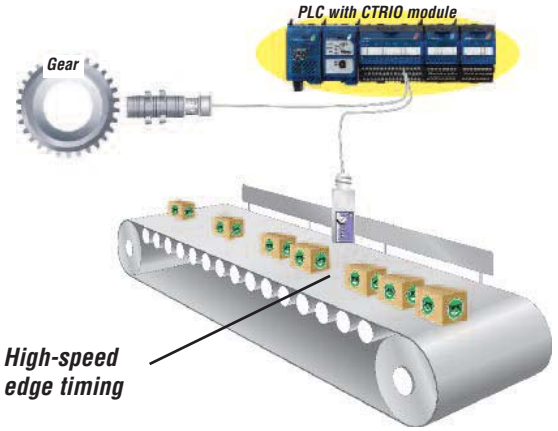
- Pulse train - used for servo/stepper motor control. Configurable for CW/CCW or step and direction.
- Discrete outputs - assigned to Counter/Timer input functions
- Raw output - outputs controlled directly from the CPU interface program

Improved to Do-more!

All your CTRIO configuration is done through the Do-more Designer Software - no more separate software "workbench". And if you should need to replace a high-speed module, all the setup parameters and profiles are stored in the CPU and are automatically loaded and ready to go when the system powers up.

High-speed timing

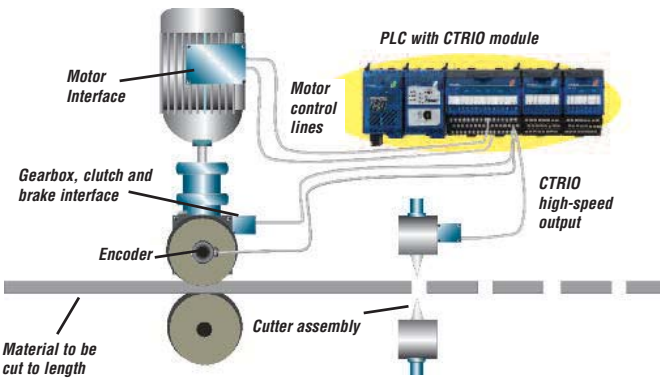
The T1H-CTRIO module can be configured for timing functions based on both count or rate. Using a common configuration of a proximity switch sensing the teeth on a gear, the module is able to calculate the velocity of the gear based on the rate at which it receives counts. This value can be scaled within the module to the engineering units required for the application.



High-speed counting

The T1H-CTRIO module can be configured for counting functions via the use of an encoder input. Up to two quadrature encoders per CTRIO module are available with connections for external reset, capture and inhibit signals. In a simple cut-to-length application as shown below, the encoder provides an input position reference for the material to the module. The module's high-speed outputs are wired to the cutting device and to the clutch and/or braking device. When the count from the encoder is equal to a pre-programmed setpoint within the module, the high-speed outputs are activated to stop and cut the material to a repeatable fixed length. Additionally, the clutch/brake signal can be used as an inhibit signal so counts are not accumulated while the material is being cut.

High-speed cut-to-length application



Do-more T1H Series PLC Overview

Do-more T1H Series PLC

The T1H Series PLC takes the modular and space-saving package of our Terminator I/O line and converts it into a stand-alone control system. Using Do-more Designer as a foundation, the T1H Series PLC system provides a powerful, flexible instruction set, inside a user friendly programming environment.

Do-more T1H PLC System with T1H-DM1E CPU Module

CPU modules

The Do-more T1H Series PLC offers two CPU modules, T1H-DM1 and T1H-DM1E, both of which must be programmed using the Do-more Designer programming software version 1.2 or later.

T1H-DM1

T1H-DM1E (with Ethernet)

Base units

The Do-more T1H Series PLC supports all of the base units available for the Terminator I/O line.

Do-more T1H Series PLC Overview

Discrete I/O modules

The Do-more T1H Series PLC supports all of the discrete I/O modules available in the Terminator I/O product line.

Analog I/O modules

The Do-more T1H Series PLC supports all of the analog I/O modules available in the Terminator I/O product line.

Specialty module

The Do-more T1H Series PLC supports the T1H-CTRIO High-Speed Counter I/O module that is available in the Terminator I/O product line.

T1H-CTRIO

Programming Software

The Do-more T1H Series PLC can only be programmed by Do-more Designer version 1.2 or later.

Do-more T1H Series PLC Overview

Module Compatibility

The following table shows which Terminator I/O product line components are supported by the T1H-DM1 and T1H-DM1E Do-more CPUs.

Module Compatibility Table					
Module	**Part Number**	**Status**	**Module**	**Part Number**	**Status**
Base Units	T1K-08B	✓	***Analog I/O Modules***	T1F-08AD-1	✓
	T1K-08B-1	✓		T1F-08AD-2	✓
	T1K-16B	✓		T1F-16AD-1	✓
	T1K-16B-1	✓		T1F-16AD-2	✓
Discrete I/O Modules	T1K-08ND3	✓		T1F-14THM	✓
	T1K-16ND3	✓		T1F-16RTD	✓
	T1K-08NA-1	✓		T1F-08DA-1	✓
	T1K-16NA-1	✓		T1F-08DA-2	✓
	T1K-08TD1	✓		T1F-16DA-1	✓
	T1K-16TD1	✓		T1F-16DA-2	✓
	T1K-08TD2-1	✓		T1F-8AD4DA-1	✓
	T1K-16TD2-1	✓		T1F-8AD4DA-2	✓
	T1H-08TDS	✓	***Specialty Module***	T1H-CTRIO	✓
	T1K-08TA	✓			
	T1K-16TA	✓			
	T1K-08TAS	✓			
	T1K-08TR	✓			
	T1K-16TR	✓			
	T1K-08TRS	✓			

✓ = Supported

Do-more T1H Series PLC Overview

Communications

The Do-more T1H Series PLC supports many communication protocols. The following table shows which CPU module communications port supports each protocol.

Protocols	CPU Modules		
	T1H-DM1 / T1H-DM1E		T1H-DM1E
	USB Port	RS-232 Serial Port	Ethernet Port
Do-more Designer Programming	Yes	Yes	Yes
Modbus/RTU Client (Master)		Yes	
Modbus/RTU Server (Slave)		Yes	
Modbus/TCP Client (Master)			Yes
Modbus/TCP Server (Slave)			Yes
DirectLOGIC RX/WX Client (Master)			Yes
DirectLOGIC RX/WX Server (Slave)			Yes
K-Sequence Server (Slave)		Yes	
DirectNET Server (Slave)			
HEI Ethernet I/O Master			Yes
SMTP (EMail) Client w/Authentication			Yes
Simple Network Time Protocol (SNTP) Client			Yes
Do-more/PEERLINK			Yes
Do-more Time Synchronization Protocol (Client, Server, Alternate Client)			Yes
Do-more Logger/UDP			Yes
Serial ad-hoc ASCII/Binary Programatic Control		Yes	
UDP ad-hoc Programmatic Control			Yes
TCP Client Programmatic Control			Yes
TCP Server Programmatic Control			Yes

Blank = Not Supported

Do-more T1H Series PLC Overview

Do-more T1H Series PLC Hardware User Manual (T1H-DM-M)

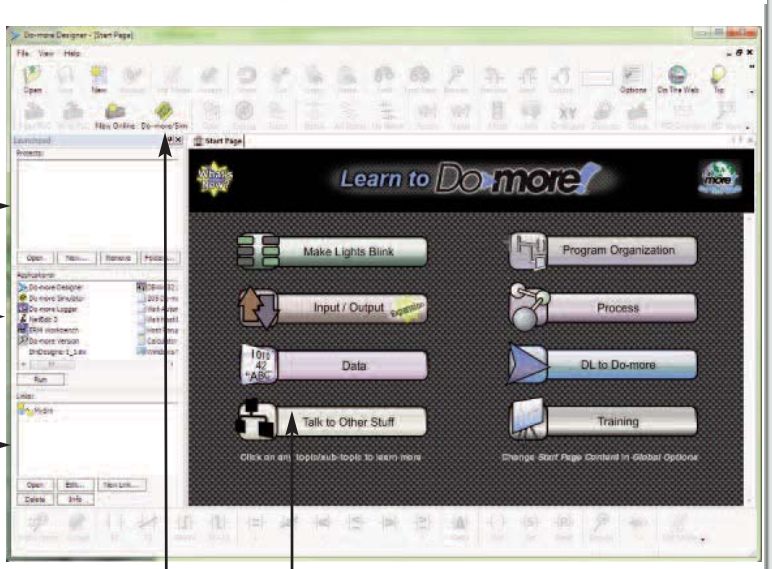
Do-more T1H Series PLC Hardware User Manual is available as a free download from Automationdirect.com. A hard copy is also available for purchase.

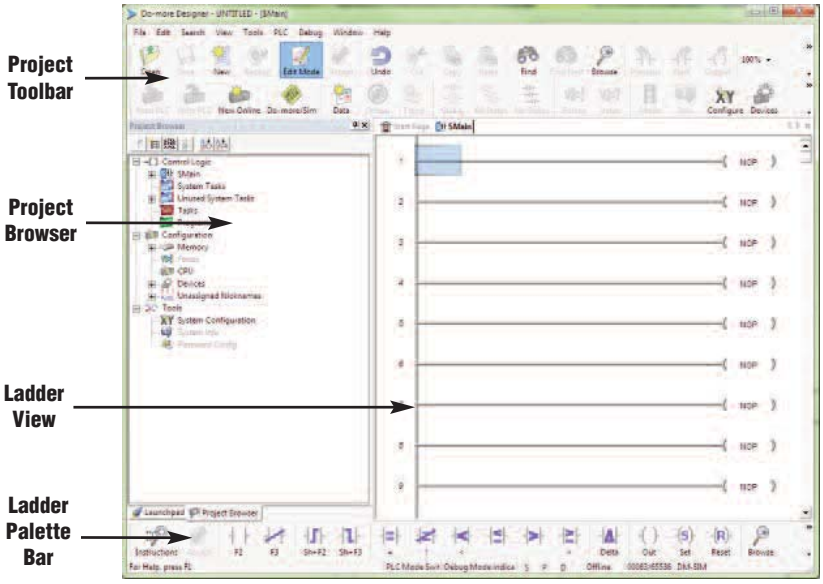
Do-more Designer (Part No. DM-PGMSW)

Do-more Designer is the full-featured programming software for the Do-more PLC series. Do-more Designer is a free download from Automationdirect.com. A CD-ROM version is also available for purchase.

Start Page

When the software is started, the Start Page is displayed. This page contains a Launchpad with Projects, Applications and Links windows. It also contains shortcuts to important help file topics, and you can start the Do-more Simulator from this page.





Main Programming Window

The Main Programming Window is displayed when a new project is started or an existing project is opened. It is divided into Menus, Toolbars, and Windows that work together to make project development simple.

Do-more T1H Series PLC Overview

Do-more Designer Features

Do-more Designer has the following main features:

- Supports the Do-more PLC instruction set
- Project Browser (Window to organize the user project)
- Data View (Interface to monitor and edit PLC data in a list)
- Trend View (Interface to monitor PLC data with trend graphs)
- PID View (Interface to monitor and tune the individual PID control loop)
- PID Overview (Interface to monitor multiple PID control loops)
- Debug View (Interface to debug the ladder programs)

When Do-more Designer is installed on your PC, the following tools are also installed:

- Do-more Simulator (Offline simulator of ladder program execution and PID control)
- Do-more Logger (Software tool to log PLC data)
- ERM Workbench (Configuration tool for the ERM modules)
- NetEdit 3 (Configuration tool for the ECOM/EBC Ethernet modules)

PC Requirements

The Do-more Designer Windows-based programming software works with Windows® XP (Home or Professional, 32-bit), Vista (Home, Basic, Premium, 32 or 64-bit), Windows 7 (Home, Professional, Ultimate, 32 or 64-bit) or Windows 8 (Home, Professional, Enterprise 32 or 64-bit; Windows 8 RT edition is NOT supported). Please check the following requirements when choosing your PC configuration:

- Minimum PC to PLC Connectivity, at least one of the following:
  - USB Port: connects to the CPU with USB-A connector (USB-A to USB-B cable)
  - RS-232 Serial Port: connects to the CPU with RJ-12 connector (RJ-12 to DB9 or RJ-12 to USB-B serial converter cable)
  - Ethernet Port: connects to the CPU (T1H-DM1E) with RJ-45 10Base-T or 100Base-T (Cat5 Patch Cable)
- Hard Disk: 100MB free disk space
- Video Display: 1024x768, 256 colors resolution (1280x720, true color recommended)
- Windows XP, 32-bit:
  - 800MHz, single core CPU (2GHz, multi-core or hyperthreaded recommended)
  - 512MB RAM (2GB recommended)
- Vista or Windows 7 or Windows 8, 32 or 64-bit:
  - 1GHz, single core CPU (2GHz, multi-core recommended)
  - 1GB RAM (3GB recommended)

Programming Cables

The Do-more T1H Series CPU module T1H-DM1 has two communication ports (USB and RS-232 Serial) and the T1H-DM1E has three communication ports (USB, RS-232 Serial and Ethernet). You can use any of those ports for programming and monitoring. Cables for these ports are listed below and can be purchased at Automationdirect.com.

USB Cables (USB 2.0, Type A-B connectors):

- USB-CBL-AB3 (3 ft.)
- USB-CBL-AB6 (6 ft.)
- USB-CBL-AB10 (10 ft.)
- USB-CBL-AB15 (15 ft.)

RS232 Serial Cable

- D2-DSCBL (12 ft. 9-pin D-sub to RJ12 connector)

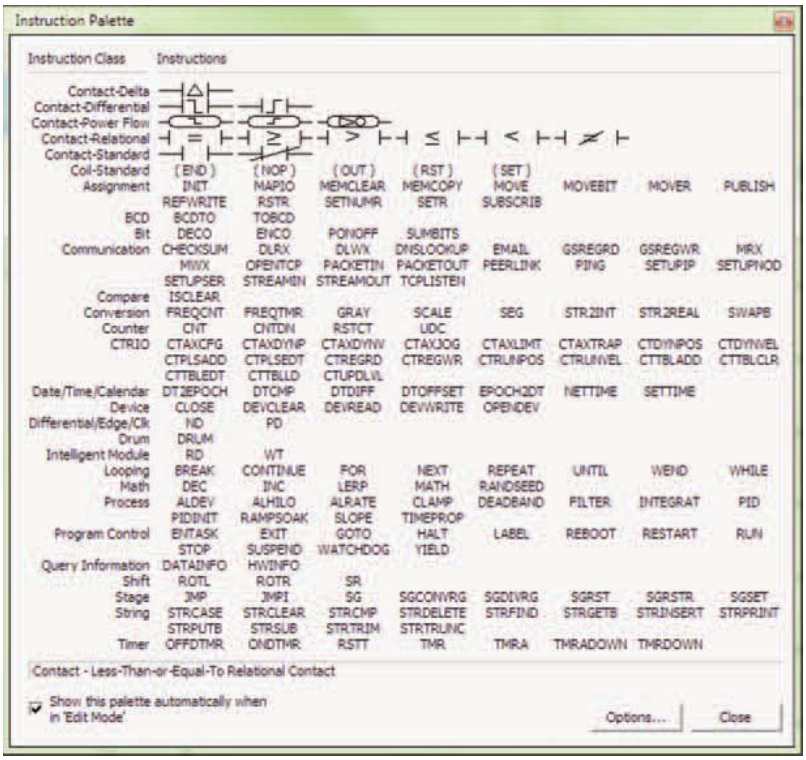
Ethernet Cables (Cat5e)

Automationdirect.com sells many Ethernet patch cables in various colors and lengths. Please check the Cables section in this catalog for further details.

Do-more T1H Series PLC Overview

Do-more PLC Instruction Set

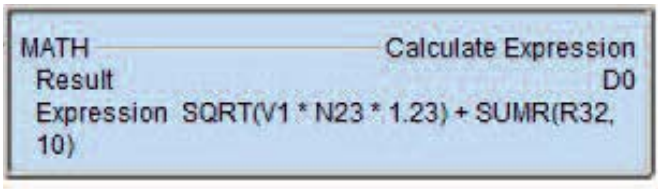
This Instruction Set was developed specifically for the new Do-more PLC series; the 'Instruction Palette' displays all available instructions.



You may see some similarities to the DirectLOGIC PLC instruction set. However, the instruction set for the Do-more PLC is more advanced and intuitive. A good example is the MATH instruction. Now, just one MATH instruction covers all math operations and also allows you to mix different data types in one expression.

There are over 60 operators and functions available with the MATH instruction.

Note: To learn more about the MATH instruction, please refer to the Do-more Designer help topic 'MATH – Calculate Expression'.



Operators

+, -, *, /, %, **, <, <=, ==, !=, >=, >, &&, ||, &, |, ^, <<, >>, >>>, -, ~, !

Functions

ABS, ACOS, ASIN, ATAN, AVGR, COS, COUNTIFEQ, COUNTIFNE, COUNTIFGE, COUNTIFGT, COUNTIFLE, COUNTIFLT, DEG, E, FRAC, IF, LN, LOG, MAXR, MAX, MINR, MIN, NOW, PI, RAD, RANDINT, RANDREAL, REF, ROUND, SIN, SQRT, STDEVR, STDEVPR, SUMIFEQ, SUMIFNE, SUMIFGE, SUMIFGT, SUMIFLE, SUMIFLT, SUMR, TAN, TICKms, TICKus, TOINT, TOREAL, TRUNC

Do-more T1H Series PLC Overview

Data Types

The Do-more PLC supports the following seven primary data types:

- Bit (0 or 1)
- Unsigned Byte (0 to 255)
- Signed Byte (-128 to 127)
- Unsigned Word (0 to 65,535)
- Signed Word (-32,768 to 32,767)
- Signed DWord (-2,147,483,648 to 2,147,483,647)
- Real (-3.4028235E+038 to 3.4028235E+038)

Data Structures

The Do-more PLC supports data structures as additional data types. Structures use the familiar PC programming organization of "dot notation". All available elements of a structure are shown in this format. The following data structures are currently available:

- Timer Structure
- Counter Structure
- String Structure
- PID Structure
- Date/Time Structure
- Task Structure
- Rampsoak Structure
- Program Structure
- DeviceRef Structure
- Drum Structure
- Stream Structure
- SIM_Process Structure
- Server Structure
- Peerlink Structure
- I/O_Master Structure
- Eth_IO_Master Structure
- GS Drive Structure
- Packet Structure

The data structure is a set of data. For instance, a Timer structure (Timer Struct) has the following set of data:

- Acc (Accumulated Time, Signed DWord)
- Done (Bit)
- Zero (Bit)
- Timing (Bit)
- Reset (Bit)

When you use a timer instruction (TMR), a Timer structure is assigned to the instruction. If you select 'T0', you can access the above data with dot notation. For instance, to access the accumulated time (Acc), enter 'T0.Acc'. To access the Done bit, enter 'T0.Done'.

Memory Addressing

With the Do-more PLC, each memory address type has its own specific data type. Here are some examples:

- V (Unsigned Word)
- N (Signed Word)
- D (Signed DWord)
- R (Real)

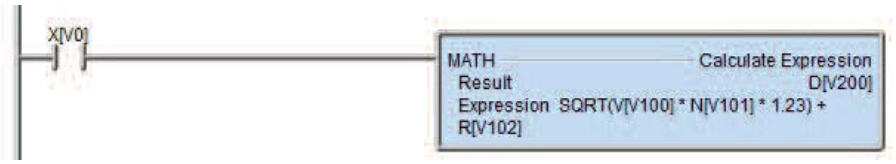
If you see address 'V123' in the ladder program, the memory address always stores an Unsigned Word value. With this memory addressing method, it becomes easier to read and write the ladder programs.

Although most of the memory addressing is decimal, the memory addresses DLX, DLY, DLC and DLV use octal. These four memory address types can be used to exchange data with DirectLOGIC PLCs, which use octal memory addressing.

Do-more T1H Series PLC Overview

Array Addressing

The Do-more PLC supports one-dimensional array addressing with all memory addresses. A V-memory address must be used as the index for an array. With the Do-more PLC, the following ladder program is valid.



Note: In this example, V0, V100, V101, V102 and V200 are indices.

Code-block, Program and Task

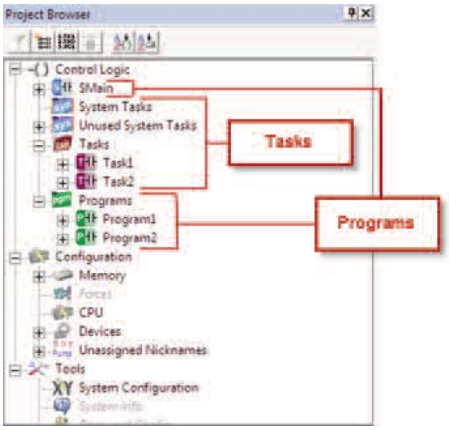
One Do-more project can consist of more than one ladder program. Each ladder program is called a 'Code-block'. The Do-more PLC supports two types of code-blocks, Program and Task:

Program

Programs are code-blocks that run based on an event using the RUN instruction. They can be self-terminating or never terminate. Stage programming is only supported inside Program code-blocks.

Task

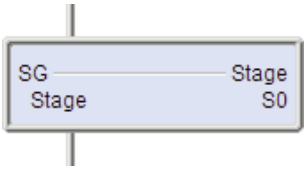
Tasks are code-blocks that are enabled and disabled using the ENTASK instruction. The ENTASK instruction allows you to specify an interval to execute the task's logic with a millisecond resolution or to execute a single time on a leading edge input.

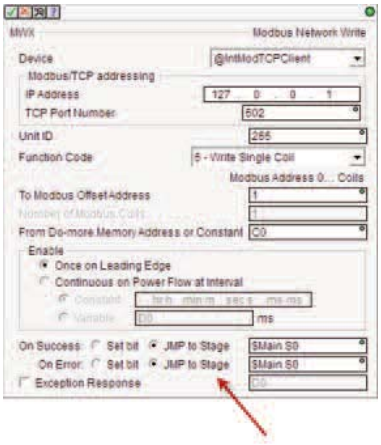


Stages

The Do-more PLC supports Stages. You can use Stages only in the Program code-blocks. (They are not available in the Task code-blocks.) The Do-more PLC supports the following instructions for Stage Programming[1]:

- SG (Stage)
- JMP (Jump To Stage)[2]
- JMPI (Index Jump)
- SGSET (Enable Stage)
- SGRST (Disable Stage)
- SGRSTR (Disable Range of Stages)
- SGCONVRG (Converge Multiple Stages to SG)
- SGDIVRG (Jump to Multiple Stages)





1 There is no ISG (Initial Stage) instruction for the Do-more PLC; the first stage in the Program code-block becomes the initial stage automatically.

2 Many asynchronous instructions can directly initiate a Jump to Stage.

Do-more T1H Series PLC System Specifications

General Specifications

General Specifications	
Ambient Operating Temperature	32°F to 131°F (0°C to 55°C)
Storage Temperature	-4°F to 158°F (-20°C to 70°C)
Ambient Humidity	5% to 95% (Non-condensing)
Atmosphere	No corrosive gases. The level of environmental pollution = 2 (UL 840)
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD 810C, Method 516.2
Voltage Withstand (Dielectric)	1500 VAC, 1 minute
Insulation Resistance	500 VDC, 10 MΩ
Noise Immunity	NEMA ICS3-304 Impulse noise 1µs, 1000 V FCC class A RFI (144 MHz, 430 MHz 10 W, 10 cm)
Agency Approvals	UL E185989, CE, FCC class A, NEC Class 1 Division 2

Do-more T1H Series PLC System Specifications

Module Placement and I/O Usage Tables

There are no I/O module placement restrictions with the Do-more T1H Series PLC family. In general, any mix of up to 16 analog and discrete I/O module types can be used in any local or Ethernet I/O base. Specialty modules can also be used in any local or Ethernet I/O base. Reference the Module Placement Restrictions table to the right for the Do-more T1H Series PLC.

Analog I/O in the Ethernet I/O bases

When using an analog module in an Ethernet I/O base, the analog update time to the CPU will be asynchronous to the scan time. Critical analog I/O should be located in the local base.

I/O point usage

The table to the right indicates the number of I/O points consumed by each module. These X (discrete input), Y (discrete output), WX (analog input) and WY (analog output) addresses are automatically assigned by Do-more Designer.

Module Placement Restrictions

Module/Unit	*Local CPU Base*	*Ethernet I/O Base*
CPUs	CPU slot only	
Discrete I/O	✓	✓
Analog I/O	✓	✓
Base Controller T1H-EBC100		CPU slot only
Specialty Module T1H-CTRIO	✓	✓

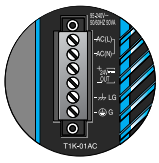
I/O Module Point Usage

DC INPUT		*RELAY OUTPUT*		*SPECIALTY MODULES*	
T1K-08ND3 T1K-16ND3	8 X 16 X	T1K-08TR T1K-16TR T1K-08TRS	8 Y 16 Y 8 Y	T1H-CTRIO	None
AC INPUT					
T1K-08NA-1 T1K-16NA-1	8 X 16 X				
DC OUTPUT		***ANALOG***			
T1K-08TD1 T1K-16TD1 T1K-08TD2-1 T1K-16TD2-1 T1H-08TDS	8 Y 16 Y 8 Y 16 Y 8 Y	T1F-08AD-1 T1F-08AD-2 T1F-16AD-1 T1F-16AD-2 T1F-16RTD T1F-14THM T1F-08DA-1 T1F-08DA-2 T1F-16DA-1 T1F-16DA-2 T1F-8AD4DA-1 T1F-8AD4DA-2	8 X, 8 WX 8 X, 8 WX 16 X, 16 WX 16 X, 16 WX 16 X, 16 WX 16 X, 16 WX 8 Y, 8 WY 8 Y, 8 WY 8 Y, 16 WY 8 Y, 16 WY 8 X, 8 WX/8 Y, 4 WY 8 X, 8 WX/8 Y, 4 WY		
AC OUTPUT					
T1K-08TA T1K-16TA T1K-08TAS	8 Y 16 Y 8 Y				

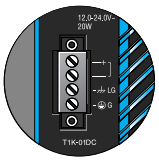
Do-more T1H Series PLC System Specifications

Power supplies

The T1H Series PLC offers two power supply options: AC or DC. More than one power supply can be installed in a T1H series PLC system with each power supply positioned to the left of the modules they supply power to.



T1K-01AC



T1K-01DC

Power supply specifications

Power Supply Specifications		T1K-01AC <--->	T1K-01DC <--->
Input Voltage Range		110/220 VAC	12/24 VDC
Input Frequency		50/60 Hz	N/A
Maximum Power		50 VA	30 W
Max. Inrush Current		20 A	10 A
Insulation Resistance		> 10 MΩ @ 500 VDC	
Voltage Withstand		1 min. @ 1500 VAC between primary, secondary and field ground	
5VDC PWR	Voltage	5.25 VDC	5.25 VDC
	Current Rating	2000 mA max (see the table below)	2000 mA max
	Ripple	5% max.	5% max.
24VDC PWR	Voltage	24 VDC	N/A
	Current Rating	500 mA max. (see the table below)	N/A
	Ripple	10% max.	N/A
Fuse	1 (primary), not replaceable		
Replacement Terminal Block (Phoenix Contact)		MVSTBW 2.5/4-ST-5.08 BK	MVSTBW 2.5/6-ST-5.08 BK

T1K-01AC Current Output		
5VDC PWR	2000 mA	1500 mA
24VDC PWR	300 mA	500 mA

Note: 500 mA @ 24VDC can be achieved by lowering the 5 VDC from 2000 mA to 1500 mA.

Power requirements

Module	5VDC	24VDC
CPU Modules		
T1H-DM1	250	0
T1H-DM1E	275	0
Interface Module		
T1H-EBC100	300	0
DC Input Modules		
T1K-08ND3	35	0
T1K-16ND3	70	0
AC Input Modules		
T1K-08NA-1	35	0
T1K-16NA-1	70	0

Module	5VDC	24VDC
DC Output Modules		
T1H-08TDS	200	0
T1K-08TD1	100	200*
T1K-16TD1	200	400*
T1K-08TD2-1	100	0
T1K-16TD2-1	200	0
AC Output Modules		
T1K-08TA	250	0
T1K-16TA	450	0
T1K-08TAS	300	0
Relay Output Modules		
T1K-08TR	350	0
T1K-16TR	700	0
T1K-08TRS	400	0
Specialty Module		
T1H-CTRIO	400	0

* Use either internal or external source for 24VDC

Module	5VDC	24VDC
Analog Input Modules		
T1F-08AD-1	75	50*
T1F-08AD-2	75	50*
T1F-16AD-1	75	50*
T1F-16AD-2	75	50*
T1F-14THM	60	70*
T1F-16RTD	150	0
Analog Output Modules		
T1F-08DA-1	75	150*
T1F-08DA-2	75	150*
T1F-16DA-1	75	150*
T1F-16DA-2	75	150*
Combination Analog Modules		
T1F-8AD4DA-1	75	60*
T1F-8AD4DA-2	75	70*

* Use either internal or external source for 24VDC

Calculating the power budget

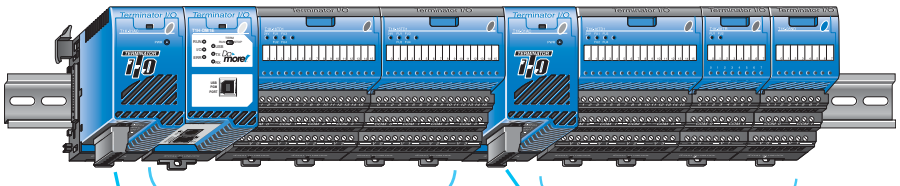
To calculate the power budget, read the available power (current rating) from the Power Supply Specifications table and subtract the power consumed by each module to the right of the power supply. Do not include modules to the right of an additional power supply.

Power Budget Example		
Module	5VDC	24VDC
T1K-01AC	+2000 mA	+300 mA
T1H-DM1E	-275 mA	-0 mA
T1K-16ND3	-70 mA	-0 mA
T1K-16TD2-1	-200 mA	-0 mA
T1F-08AD-1	-75 mA	-50 mA
Remaining	+1380 mA	+250 mA

Adding additional power supplies

Each power supply furnishes power only to the modules to its right. Inserting a second power supply closes the power loop for the power supply to the left, while also powering the modules to its right. Perform a power budget calculation for each power supply in the system.

Accessories available for Terminator I/O are listed in the Terminator Field I/O section of the Price List



This power supply powers the CPU module and the next two I/O modules

This power supply powers these three I/O modules

CPU Modules

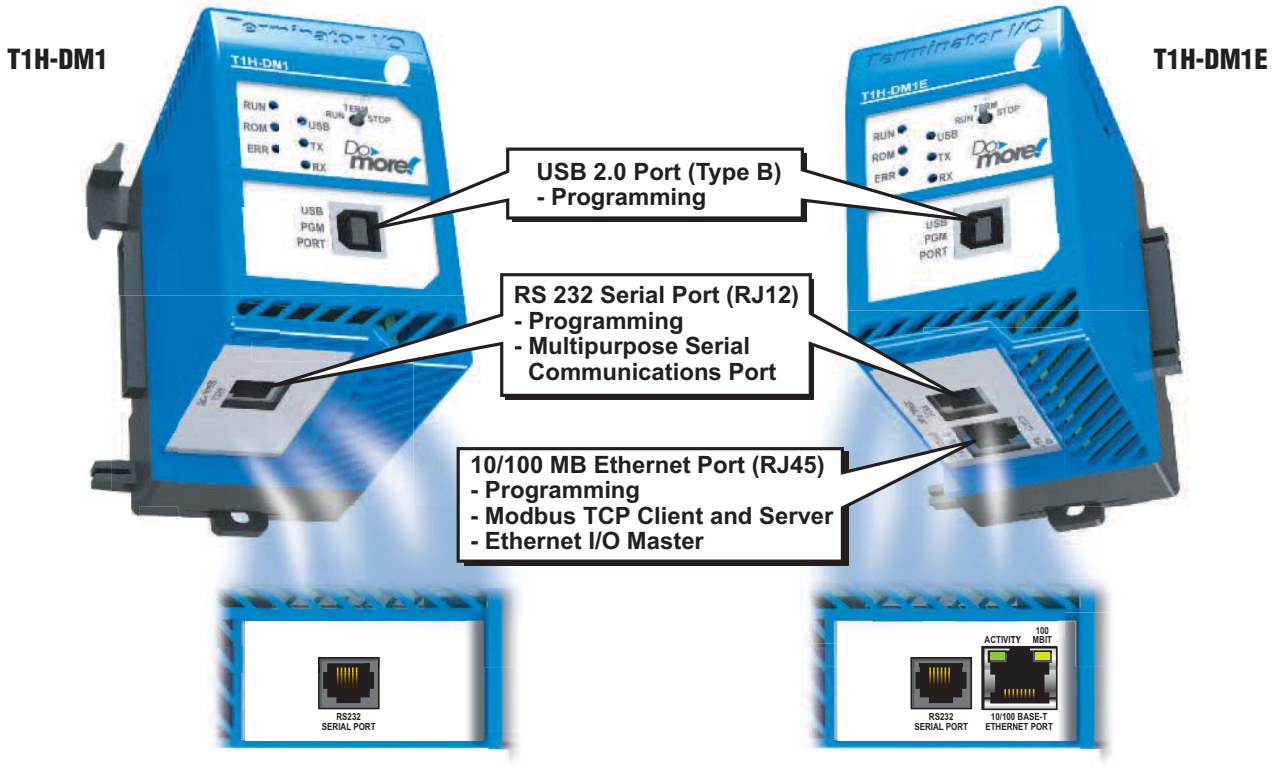
Specifications

T1H-DM1 <--->

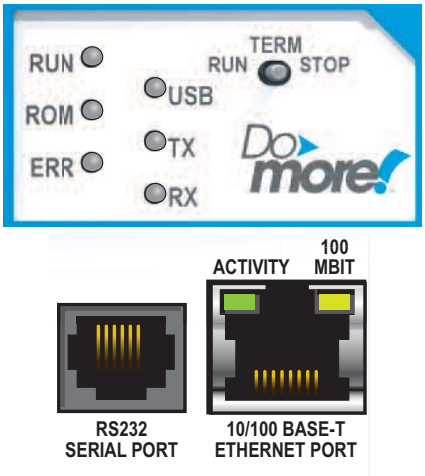
T1H-DM1E <--->

Feature	T1H-DM1	T1H-DM1E
Total Memory (bytes)	262,144 bytes	
Ladder Memory (instruction words)	65,536 instruction words	
V-Memory (words)	Configurable up to 65536 (4096 default)	
Non-volatile V Memory (words)	Configurable up to 65536 (4096 default)	
D-memory (DWORDs)	Configurable up to 65536 (4096 default)	
Non-volatile D Memory (DWORDs)	Configurable up to 65536 (4096 default)	
R-memory (REAL DWORDs)	Configurable up to 65536 (4096 default)	
Non-volatile R Memory (REAL DWORDs)	Configurable up to 65536 (4096 default)	
Boolean execution	50 uSec	
Stage Programming	Yes	
Number of Stages	128 per Program code-block; number of code-blocks configurable to memory limit	
Handheld Programmer	No	
Programming Software for Windows	FREE Do-more Designer version 1.2 or newer	
Built-In communications ports	USB, RS-232	USB, RS-232, Ethernet (10/100 Base-T)
Program Memory	Flash ROM	
Total I/O points available	X, Y, each configurable up to 65536 (2048 default); WX, WY (analog in/out) each configurable up to 65536 (256 default)	
Max Number of Local I/O Modules	16	
Local I/O points available	256	
Ethernet I/O Discrete points	131,072	
Ethernet I/O Analog I/O Channels	32,768	
Max Number of Ethernet slaves per PLC	16	
I/O points on Ethernet I/O	32,768	
Discrete I/O Module Point Density	8/16	
Number of instructions available	>160	>170
Control relays	Configurable up to 65536 (2048 default)	
Special relays (system defined)	1024	
Special registers (system defined)	512	
Timers	Configurable up to 65536 (256 default)	
Counters	Configurable up to 65536 (256 default)	
System Date/Time structures	8	
User Date/Time structures	Configurable up to 65536 (32 default)	
ASCII String/Byte buffer structures	Configurable up to memory limit (192 default)	
Modbus Client memory	Yes, configurable up to memory limit, default 1024 input bits, 1024 coil bits, 2048 input registers, 2048 holding registers	
DL Classic Client memory	Up to memory limit, default 512 X, 512 Y, 512 C, 2048 V	
Immediate I/O	No	
Interrupt input (hardware / timed)	No	
Subroutines	Program and Task code-blocks, up to memory limit	
Drum Timers	Yes, up to memory limit	
Table Instructions	Yes	
Loops	FOR/NEXT, WHILE/WEND, REPEAT/UNTIL loops	
Math	>60 operators and functions: Integer, Floating Point, Trigonometric, Statistical, Logical, Bitwise, Timing	
ASCII	Yes, IN/OUT, Serial, Ethernet TCP and UDP; 11 output script commands	
PID Loop Control, Built In	Yes, configurable to memory limit (over 2,000)	
Time of Day Clock/Calendar	Yes	
Run Time Edits	Yes	
Supports True Force	Yes	
Internal Diagnostics	Yes	
Password security	Multi-user, credentialed, session-based security	
System error log	Yes	
User error log	Yes	
Battery backup	Yes (Battery included)	

CPU Modules



LED Status Indicators



LED Indicators		
Indicator	**Status**	**Description**
RUN	Green	CPU is in RUN Mode
	Yellow	Forces are Active
ROM	Yellow	CPU is updating Non-volatile Memory
ERR	Red	CPU Fatal Error
	Yellow	Low Battery
	Green	Status OK (good)
USB	Green	USB Receive Activity
	Yellow	USB Transmit Activity
TX	Green	RS-232 Transmit Activity
RX	Green	RS-232 Receive Activity
ACTIVITY	Green	Ethernet Port Activity
100 MBIT	Yellow	Ethernet Port communicating at 100 MBIT Rate

PLC Mode Switch

Mode Switch Functions	
Mode Switch Position	**CPU Action**
RUN (Run Program)	CPU is forced into RUN Mode if no errors are encountered.
TERM (Terminal)	RUN, PROGRAM and DEBUG modes are available. In this switch position, the mode of operation can be changed through the Programming Software.
STOP (Stop Program)	CPU is forced into STOP Mode.

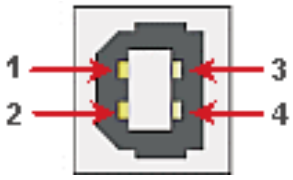
CPU Modules

Communication Ports

USB Port

Used exclusively for programming and monitoring via a PC running Do-more Designer.

USB Port Specifications	
Description	Standard USB 2.0 Slave input for programming and online monitoring, with built-in surge protection. Not compatible with older full speed USB devices.
Cables (ADC part #)	USB Type A to USB Type B: USB-CBL-AB3 (3 ft.) USB-CBL-AB6 (6 ft.) USB-CBL-AB10 (10 ft.) USB-CBL-AB15 (15 ft.)



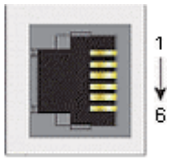
Pin	Description	
1	5V	Bus Voltage Sense
2	D-	Data -
3	D+	Data +
4	0V	Ground

RS-232 Port

RJ-12 style connector used for:

- Connection to a PC running Do-more Designer
- Modbus RTU Master connections
- Modbus RTU Slave connections
- ASCII Incoming and Outgoing communications
- Custom Protocol Incoming and Outgoing communications

RS-232 Port Specifications	
Description	Non-isolated, full duplex RS-232 DTE port used for programming, online monitoring or can connect the CPU as a Modbus RTU or ASCII master or slave to a peripheral device. Includes ESD and built-in surge protection.
Baud Rates	1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
+5V Cable Power Source	220 mA maximum at 5V, +/- 5%. Reverse polarity and overload protected.
Maximum Output Load (TXD/RTS)	3 KΩ, 1,000 pf
Minimum Output Voltage Swing	+/-5V
Output Short Circuit Protection	+/-15 mA
Cable Options (ADC part #)	D2-DSCBL USB-RS232 with D2-DSCBL FA-CABKIT FA-ISOCON for converting RS-232 to isolated RS-422/485 EA-MG-PGM-CBL



6-pin RJ12 Female Modular Connector

Pin	Description	
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection (220 mA max.)
3	RXD	Receive Data (RS-232)
4	TXD	Transmit Data (RS-232)
5	RTS	Request to Send (RS-232)
6	CTS	Clear to Send (RS-232)

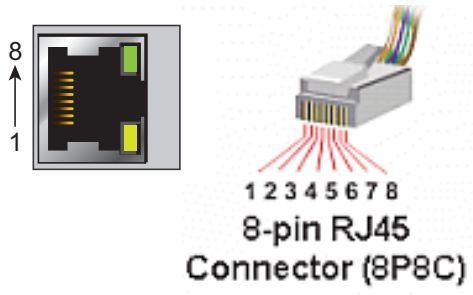
For a list of protocols supported by each port, please refer to the Communications topic of the Do-more T1H Series PLC Overview in this section.

CPU Modules

Ethernet Port

RJ-45 style connector used for:

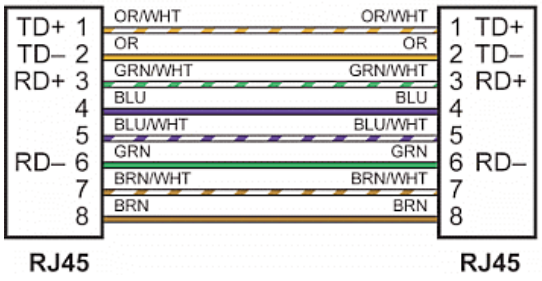
- Connection to a PC running Do-more Designer
- Modbus TCP Client connections (Modbus requests sent from the CPU)
- Modbus TCP Server connections (Modbus requests received by the CPU)
- Ethernet I/O Master



For a list of protocols supported by each port, please refer to the Communications topic of the Do-more T1H Series PLC Overview in this section.

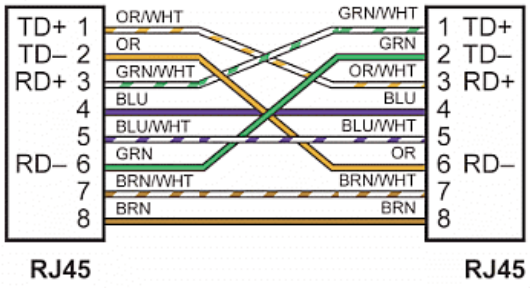
Ethernet Port Specifications	
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, Modbus/TCP client/server connections (fixed IP or DHCP) and Ethernet I/O capabilities.
Transfer Rate	10/100 Mbps
Cables	Use a Patch (Point to Point) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used.

Patch (Point to Point) Cable



Crossover Cable

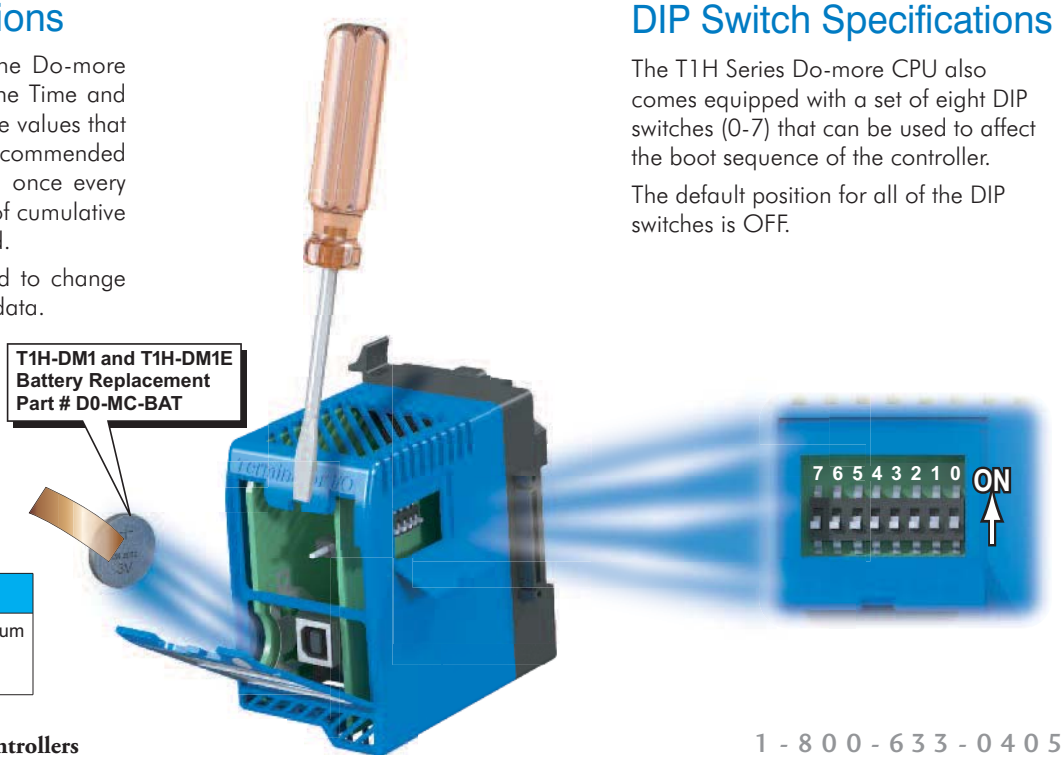
10/BASE-T/100BASE-TX



Battery Specifications

A battery is included with the Do-more CPU and is used to retain the Time and Date along with any Tagname values that are set up as retentive. It is recommended that the battery be replaced once every five years or when one year of cumulative OFF time has been exceeded.

At least two hours is allowed to change out a battery without loss of data.



Battery	
D0-MC-BAT	Coin type, 3.0V Lithium battery, number CR2032

DIP Switch Specifications

The T1H Series Do-more CPU also comes equipped with a set of eight DIP switches (0-7) that can be used to affect the boot sequence of the controller.

The default position for all of the DIP switches is OFF.

CPU Modules

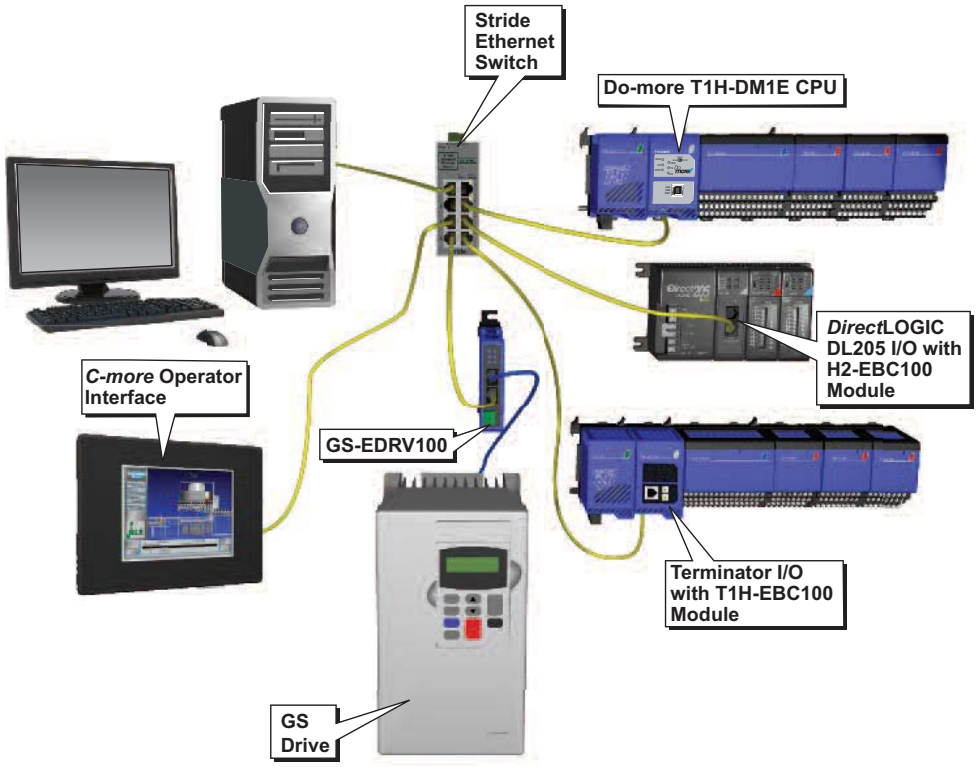
Ethernet I/O

The T1H-DM1E CPU's built-in Ethernet port can be configured as an Ethernet I/O master. The Ethernet I/O feature allows expansion beyond the local base to slave I/O using the onboard high-speed Ethernet link. The onboard Ethernet port can support up to 16 slave devices. The slave I/O modules supported are:

- H2-EBC100
- T1H-EBC100 (Terminator I/O)
- GS-EDRV100 (GS Drives)

The Ethernet I/O network uses Category 5 UTP cables for cable runs up to 100 meters (328 ft.) with extended distances achieved through Ethernet switches.

It is highly recommended that a dedicated network be used with the Ethernet I/O feature. Ethernet I/O networks and ECOM/office networks should be isolated from one another to prevent network delays.



Discrete I/O Modules

The Do-more T1H Series PLC supports all discrete I/O modules available for the Terminator I/O product line.

T1K-08ND3

T1K-16ND3

T1K-08NA-1

T1K-16NA-1

T1K-08TD1

T1K-16TD1

T1K-08TD2-1

T1K-16TD2-1

T1H-08TDS

T1K-08TA

T1K-16TA

T1K-08TAS

T1K-08TR

T1K-16TR

T1K-08TRS

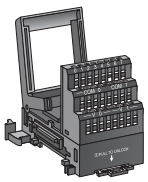
Discrete Input Modules*			
Part Number	Number of Inputs	Description	Price
T1K-08ND3	8	Sinking /Sourcing DC Input	<--->
T1K-16ND3	16	Sinking /Sourcing DC Input	<--->
T1K-08NA-1	8	AC input	<--->
T1K-16NA-1	16	AC input	<--->

***Terminal Bases sold separately**

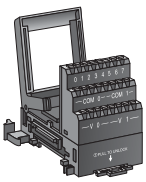
Discrete Output Modules*			
Part Number	Number of Outputs	Description	Price
T1K-08TD1	8	Sinking DC Output	<--->
T1K-16TD1	16	Sinking DC Output	<--->
T1K-08TD2-1	8	Sourcing DC Output	<--->
T1K-16TD2-1	16	Sourcing DC Output	<--->
T1H-08TDS	8	Isolated Sinking /Sourcing DC Output	<--->
T1K-08TA	8	AC Output	<--->
T1K-16TA	16	AC Output	<--->
T1K-08TAS	8	Isolated AC Output	<--->
T1K-08TR	8	Relay Output	<--->
T1K-16TR	16	Relay Output	<--->
T1K-08TRS	8	Isolated Relay Output	<--->

***Terminal Bases sold separately**

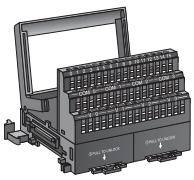
Discrete I/O modules above are shown installed in the Terminal Base. Terminal Bases are sold seperately and are listed in the table below.



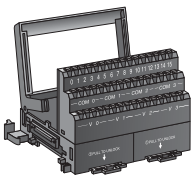
T1K-08B



T1K-08B-1



T1K-16B



T1K-16B-1

Terminal Bases			
Part Number	Number of Terminals	Description	Price
T1K-08B	8	Screw Type	<--->
T1K-08B-1	8	Spring Clamp	<--->
T1K-16B	16	Screw Type	<--->
T1K-16B-1	16	Spring Clamp	<--->

For more detailed specifications and wiring diagrams, please refer to the Terminator I/O (Field I/O) section in this catalog.

Discrete I/O Modules

The following table may be helpful for you to select the right modules for your application.

Discrete Input Modules			
Input Type	Specification	Number of Input Points per Module	
		8	16
DC (Sinking/Sourcing)	10.8 - 26.4 VDC	T1K-08ND3	T1K-16ND3
AC	80 – 132 VAC	T1K-08NA-1	T1K-16NA-1

Discrete Output Modules			
Output Type	Specification	Number of Output Points per Module	
		8	16
DC (Sinking)	1A @ 5 – 30 VDC	T1K-08TD1	T1K-16TD1
DC (Sourcing)	1A @ 10.8 – 26.4 VDC	T1K-08TD2-1	T1K-16TD2-1
DC (Sink/Source)	2A @ 5 – 36 VDC	T1H-08TDS	
AC	1A @ 15 – 264 VAC	T1K-08TA	T1K-16TA
	2A @ 15 – 264 VAC	T1K-08TAS	
Relay	2A @ 5 – 30 VDC / 5 - 264 VAC	T1K-08TR	T1K-16TR
	7A @ 5 – 30 VDC / 5 - 264 VAC	T1K-08TRS	

For more detailed specifications and wiring diagrams, please refer to the Terminator I/O (Field I/O) section in this catalog.

Analog I/O Modules

The Do-more T1H Series PLC supports all analog I/O modules available for the Terminator I/O product line.

T1F-08AD-1

T1F-08AD-2

T1F-16AD-1

T1F-16AD-2

T1F-16RTD

T1F-14THM

Analog Input Modules*			
Part Number	Number of Channels	Description	Price
T1F-08AD-1	8	Analog Current Input	<--->
T1F-08AD-2	8	Analog Voltage Input	<--->
T1F-16AD-1	16	Analog Current Input	<--->
T1F-16AD-2	16	Analog Voltage Input	<--->
T1F-16RTD	16	RTD	<--->
T1F-14THM	14	Thermocouple	<--->

***Terminal Bases sold separately**

T1F-08DA-1

T1F-08DA-2

T1F-16DA-1

T1F-16DA-2

Analog Output Modules*			
Part Number	Number of Channels	Description	Price
T1F-08DA-1	8	Analog Current Output	<--->
T1F-08DA-2	8	Analog Voltage Output	<--->
T1F-16DA-1	16	Analog Current Output	<--->
T1F-16DA-2	16	Analog Voltage Output	<--->

***Terminal Bases sold separately**

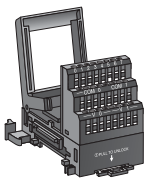
T1F-8AD4DA-1

T1F-8AD4DA-2

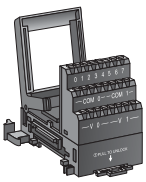
Analog Input/Output Modules*			
Part Number	Number of Channels	Description	Price
T1F-8AD4DA-1	8/4	Analog Current Input/Output	<--->
T1F-8AD4DA-2	8/4	Analog Voltage Input/Output	<--->

***Terminal Bases sold separately**

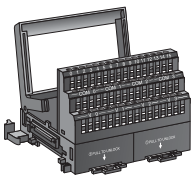
Analog I/O modules above are shown installed in the Terminal Base. Terminal Bases are sold seperately and are listed in the table below.



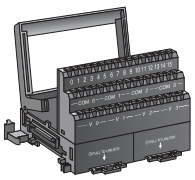
T1K-08B



T1K-08B-1



T1K-16B



T1K-16B-1

Terminal Bases			
Part Number	Number of Terminals	Description	Price
T1K-08B	8	Screw Type	<--->
T1K-08B-1	8	Spring Clamp	<--->
T1K-16B	16	Screw Type	<--->
T1K-16B-1	16	Spring Clamp	<--->

For more detailed specifications and wiring diagrams, please refer to the Terminator I/O (Field I/O) section in this catalog.

Analog I/O Modules

The following table may be helpful for you to select the right modules for your application.

Analog Input Modules				
Input Type	Specification	Number of Input Points per Module		
		8	14	16
Current	-20 to 20 mA, 0 - 20 mA, 4 – 20 mA	T1F-08AD-1 T1F-8AD4DA-1		T1F-16AD-1
Voltage	0 – 5V, 0 – 10V, ±5V, ±10V	T1F-08AD-2 T1F-8AD4DA-2		T1F-16AD-2
RTD	Pt100, Pt1000, jPt100, CU-10Ω, CU-25Ω, 120Ω Nickel			T1F-16RTD
Thermocouple	Type J, E, K, R, S, T, B, N, C		T1F-14THM	

Analog Output Modules				
Output Type	Specification	Number of Output Points per Module		
		4	8	16
Current	0 – 20 mA, 4 – 20 mA		T1F-08DA-1	T1F-16DA-1
	4 – 20 mA	T1F-8AD4DA-1		
Voltage	0 – 5V, 0 – 10V, ±5V, ±10V	T1F-8AD4DA-2	T1F-08DA-2	T1F-16DA-2

For more detailed specifications and wiring diagrams, please refer to the Terminator I/O (Field I/O) section in this catalog.

Specialty Modules

T1H-CTRIO <--->

T1H-CTRIO

Overview

The T1H-CTRIO Counter I/O module is designed to accept high-speed pulse input signals for counting or timing applications. This module provides high-speed pulse output signals for servo/stepper motor control, monitoring and alarming as well as other discrete control functions.

The CTRIO module offers greater flexibility for applications which call for precise counting or timing based on input events or for high speed control output applications. It can also be used for applications that call for a combination of both high-speed input and high-speed output control functions.

The CTRIO module has its own microprocessor and operates asynchronously with respect to the CPU. Therefore, the response time of the on-board outputs is based on the module's scan time, not the CPU's scan time.

Note: T1H CPU modules can support the H2-CTRIO and H2-CTRIO2 modules in the Ethernet I/O bases.

Software Configuration

All scaling and configuration is done from within the Edit CTRIO/CTRIO2 Configuration window of Do-more Designer. This eliminates the need for PLC ladder programming or other interface device programming to configure the module.

For more detailed specifications and wiring diagrams, please refer to the Terminator I/O (Field I/O) section in this catalog.

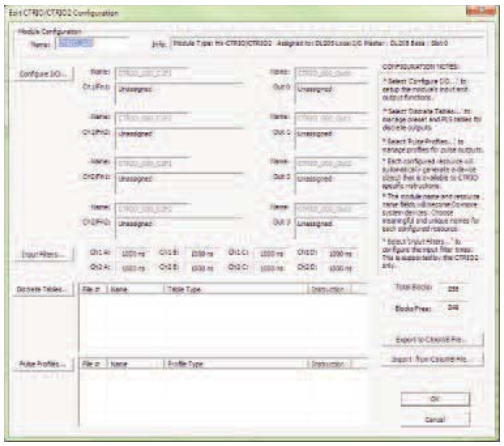
General Specifications	
Specifications	**T1H-CTRIO**
Discrete I/O Points Used	None (I/O map directly in T1H-DM1/E data structure)
Base Power Required*	400 mA Max
Isolation	2500V I/O to Logic, 1000V among Input Channels and All Outputs

***Terminal Base sold separately**

Input Specifications	
Specifications	**T1H-CTRIO**
Inputs	8 pts sink/source
Maximum Input Frequency	100 kHz
Minimum Pulse Width	5 µsec
Input Voltage Range	9-30 VDC
Maximum Voltage	30 VDC
Input Voltage Protection	Zener Clamped at 33 VDC
Rated Input Current	8 mA typical 12 mA maximum
Minimum ON Voltage	9.0 VDC
Maximum OFF Voltage	2.0 VDC
Minimum ON Current	5.0 mA
Maximum OFF Current	2.0 mA
OFF to ON Response	Less than 3 µsec
ON to OFF Response	Less than 3 µsec

Output Specifications	
Specifications	**T1H-CTRIO**
Outputs	4 pts (sink/source), independently isolated
Pulse Outputs	2 channels, 20 Hz to 25 kHz Pulse/Direction or CW/CCW
Minimum Pulse Width	5 µsec
Output Voltage Range	5-36 VDC
Maximum Output Voltage	36 VDC
Maximum Load Current	1.0A
Maximum Leakage Current	100 µA
Inrush Current	5.0A for 20 ms
ON State V Drop	0.3 VDC or less
Overcurrent Protection	15A max.
OFF to ON Response	less than 3 µsec
ON to OFF Response	less than 3 µsec
Maximum Output Frequency	
Velocity Mode	25 kHz
Run to Limit Mode	
Run to Position Mode	
Trapezoid	
S-Curve	
Symmetrical S-Curve	
Dynamic Positioning	
Home Search	
Free Form	
Dynamic Velocity	
Dynamic Positioning Plus	N/A
Trapezoid Plus	
Trapezoid with Limits	

Edit CTRIO/CTRIO2 Configuration Window



Inputs Supported:

- Counter
- Quad Counter
- Pulse Catch
- Edge Timer
- Dual Edge Timer

Outputs Supported:

- Pulse train - used for servo/stepper motor control. Configurable for CW/CCW or step and direction
- Discrete outputs - assigned to Counter/Timer input functions
- Raw output - outputs controlled directly from the CPU interface program

Dimensions and Installation

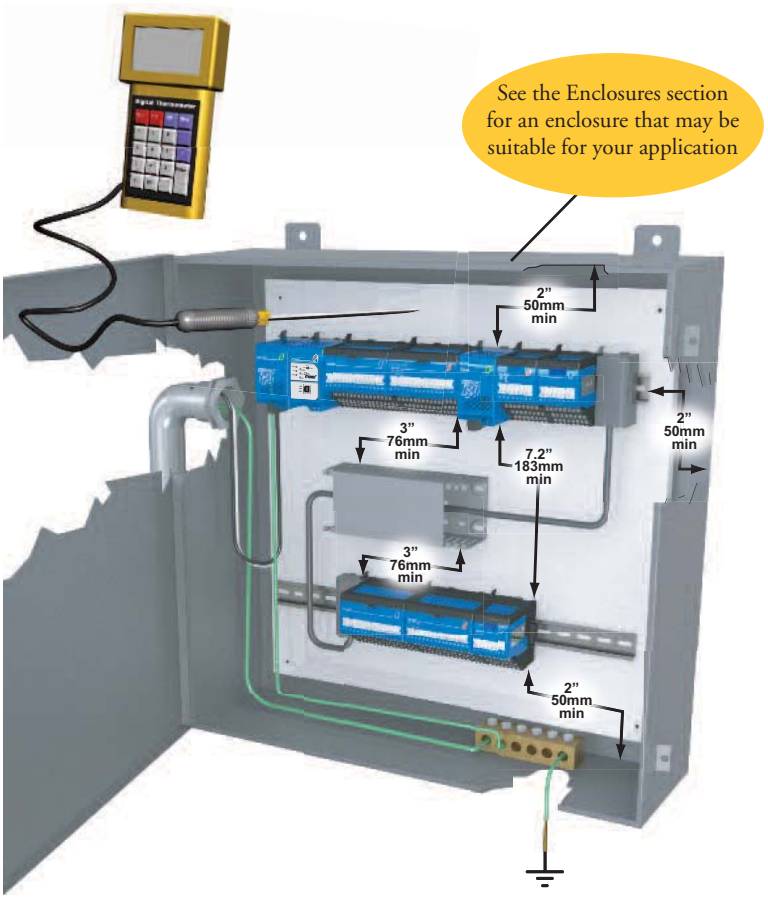
It is important to understand the installation requirements for your T1H Series PLC system. This will ensure that the PLC system works within their environmental and electrical limits.

Plan for safety

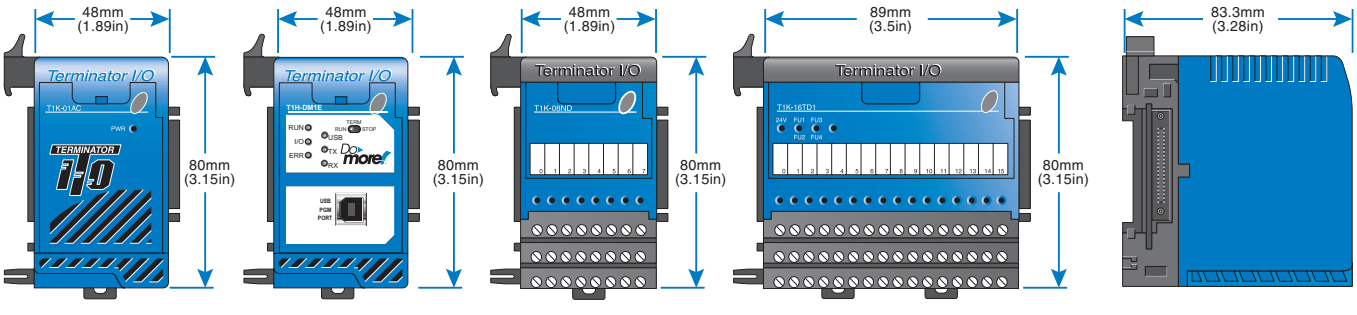
This document should never be used as a replacement for the technical data sheet that comes with the products or the Do-more T1H Series PLC Hardware User Manual (available online at www.automationdirect.com.) The technical data sheet contains information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

Unit dimensions and mounting orientation

Use the following diagrams to make sure the T1H Series PLC system can be installed in your application. The PLC system should be mounted horizontally. To ensure proper airflow for cooling purposes, units should not be mounted upside-down. It is important to check the PLC system dimensions against the conditions required for your application. For example, it is recommended to leave 2" depth for ease of access and cable clearance. However, your distance may be greater or less. Also, check the installation guidelines for the recommended cabinet clearances.


See the Enclosures section for an enclosure that may be suitable for your application
2" 50mm min
3" 76mm min
7.2" 183mm min
2" 50mm min
3" 76mm min
2" 50mm min

Terminator Environmental Specifications	
Ambient Operating Temperature	32°F to 131°F (0°C to 55°C)
Storage Temperature	-4°F to 158°F (-20°C to 70°C)
Ambient Humidity	5% to 95% (Non-condensing)
Atmosphere	No corrosive gases. The level of environmental pollution = 2 (UL 840)
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD 810C, Method 516.2
Voltage Withstand (Dielectric)	1500 VAC, 1 minute
Insulation Resistance	500 VDC, 10 MΩ
Noise Immunity	NEMA ICS3-304 Impulse noise 1µs, 1000 V FCC class A RFI (144 MHz, 430 MHz 10 W, 10 cm)
Agency Approvals	UL E185989, CE, FCC class A, NEC Class 1 Division 2



Power Supply | CPU Module | Half-size I/O Module with Base | Full-size I/O Module with Base | System Depth

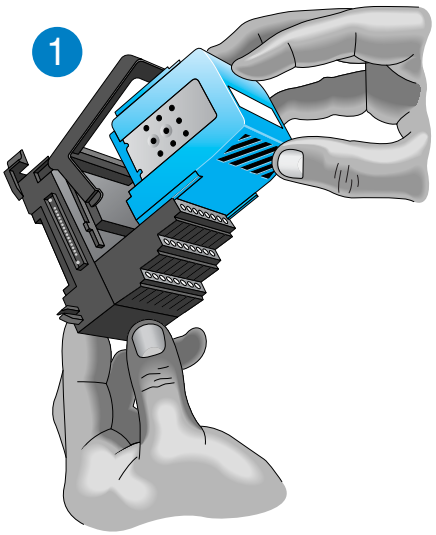
I/O Module Installation

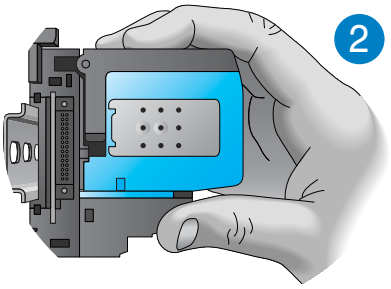
I/O module installation

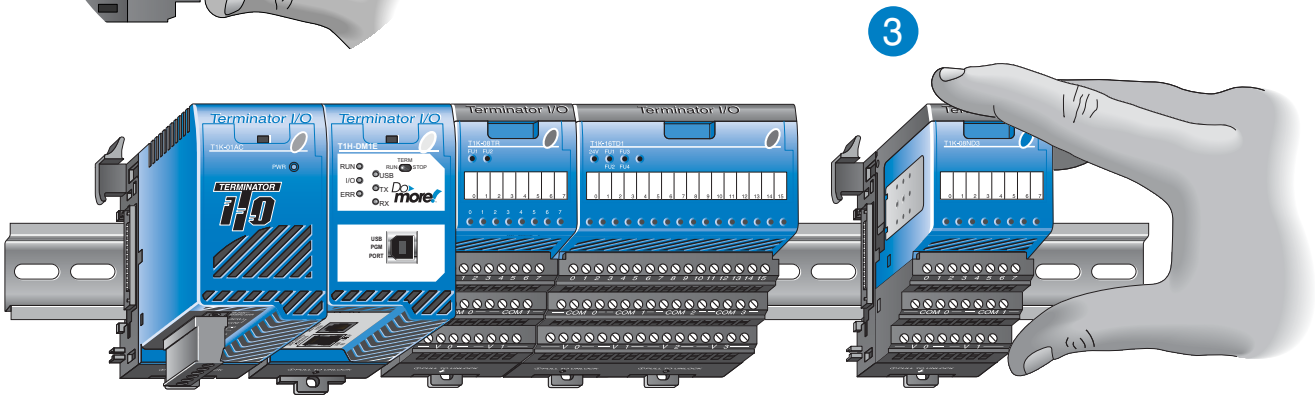
I/O modules feature separate terminal bases for easy installation.

To install I/O modules:

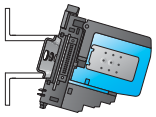
1. Slide the module into its terminal base (until it clicks into position)
2. Hook upper DIN rail tabs over the top of DIN rail, and press the assembly firmly onto the DIN rail.
3. Slide the module along the DIN rail until it engages with the adjacent module.



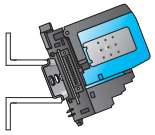




DN-ASB1 angled mounting bracket



Great for mounting in upper locations



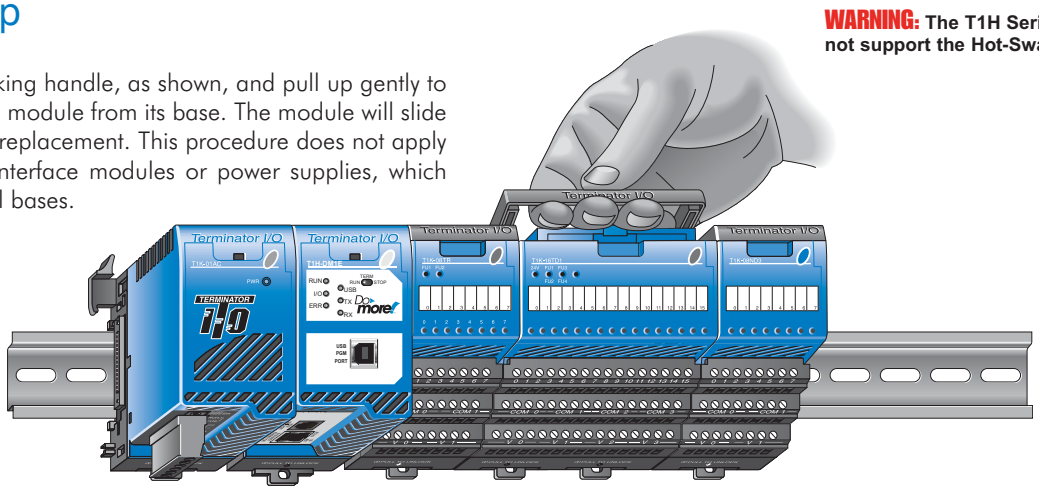
Great for mounting in lower locations

Optional angled support bracket raises and tilts the mounting rail for easier access and wiring. Use with 35 mm DIN rail. See the Connection Systems in this catalog for details.

Removing I/O modules is a snap

Grip the locking handle, as shown, and pull up gently to eject the I/O module from its base. The module will slide out for easy replacement. This procedure does not apply to network interface modules or power supplies, which have integral bases.

WARNING: The T1H Series PLC does not support the Hot-Swap feature.



Field Device Wiring and Power Options

Terminal base specifications

Terminator I/O terminal bases are available in screw clamp and spring clamp versions for both half-size and full-size modules. Hot stamp silkscreen labeling is used for numbering I/O points, commons, and all power terminals.

Terminal Base Specifications		
Terminal Type	Screw type	Spring clamp
Recommended Torque	1.77-3.54 lb-in (0.2 - 0.4 Nm)	n/a
Wire Gauge	Solid: 25-12 AWG Stranded: 26-12 AWG	Solid: 25-14 AWG Stranded: 26-14 AWG

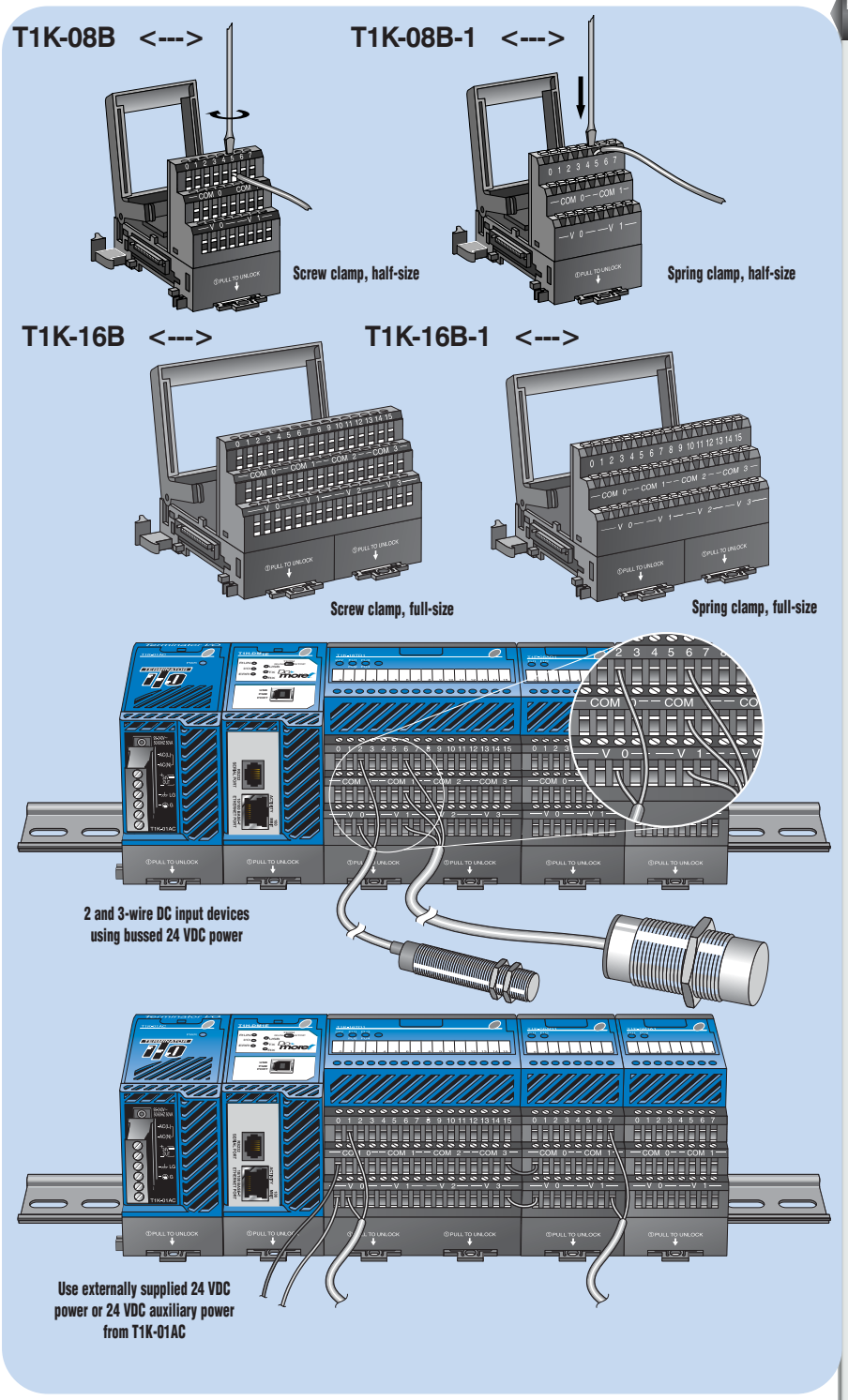
Field device wiring options

Power your DC input devices from the integrated 24 VDC power supply bus. T1K-08ND3 and T1K-16ND3 DC input modules include jumpers for selecting the internal 24 VDC power supply available for 2- and 3-wire field devices. Clearly labeled triple stack terminals make it easy to wire 2- and 3-wire devices ensuring clean wiring with only one wire per termination.

External user supplied 24 VDC power, or auxiliary 24 VDC terminals from T1K-01AC, can be easily applied directly to one end of the terminal rows and jumpered across each base in the system.

This is a convenient solution for powering analog I/O and discrete DC output devices whose modules do not have direct access to the internal bussed 24 VDC. If current consumption increases, simply add additional T1K-01AC power supplies into the system.

WARNING: The T1H Series PLC does not support the Hot-Swap feature.


T1K-08B <---->
T1K-08B-1 <--->
Screw clamp, half-size
Spring clamp, half-size
T1K-16B <--->
T1K-16B-1 <--->
Screw clamp, full-size
Spring clamp, full-size
2 and 3-wire DC input devices using bussed 24 VDC power
Use externally supplied 24 VDC power or 24 VDC auxiliary power from T1K-01AC